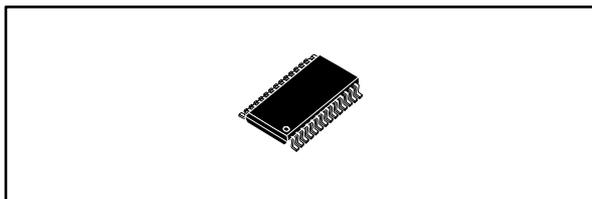

**±15 kV ESD protected 3 to 5.5 V, 400 kbps, RS-232 transceiver
with auto power-down**

Datasheet - production data

**Features**

- ESD protection for RS-232 I/O pins: ±8 kV IEC 1000-4-2 contact discharge ±15 kV human body model
- 1 µA supply current achieved when in auto power-down
- 250 kbps minimum guaranteed data rate
- Guaranteed 6 V/µs slew rate range
- Guaranteed mouse drive ability
- 0.1 µF external capacitors
- Meets EIA/TIA-232 specifications down to 3 V
- Available in SSOP 28 package

Description

The ST3241E device consists of 3 drivers, 5 receivers, and a dual charge-pump circuit. The device meets the requirements of EIA/TIA and V.28/V.24 communication standards providing high data rate capability and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver inputs are protected to ±8 kV using IEC 1000-4-2 contact discharge and ±15 kV using the human body model. The receiver R2 is always active to implement a wake-up feature for the serial port.

The ST3241E has a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a 3.0 V to 5.5 V supply with a dual charge pump. The device is guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels.

It is a complete serial port (3 drivers, 5 receivers) intended for notebook or sub-notebook computers. Receivers R1 and R2 have extra outputs in addition to their standard outputs. These extra outputs are always active.

Typical applications are in notebooks, sub-notebooks, palmtop computers, battery-powered equipment, hand-held equipment, peripherals, and printers.

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1 Pin information

Figure 1: Pin connections (top view)

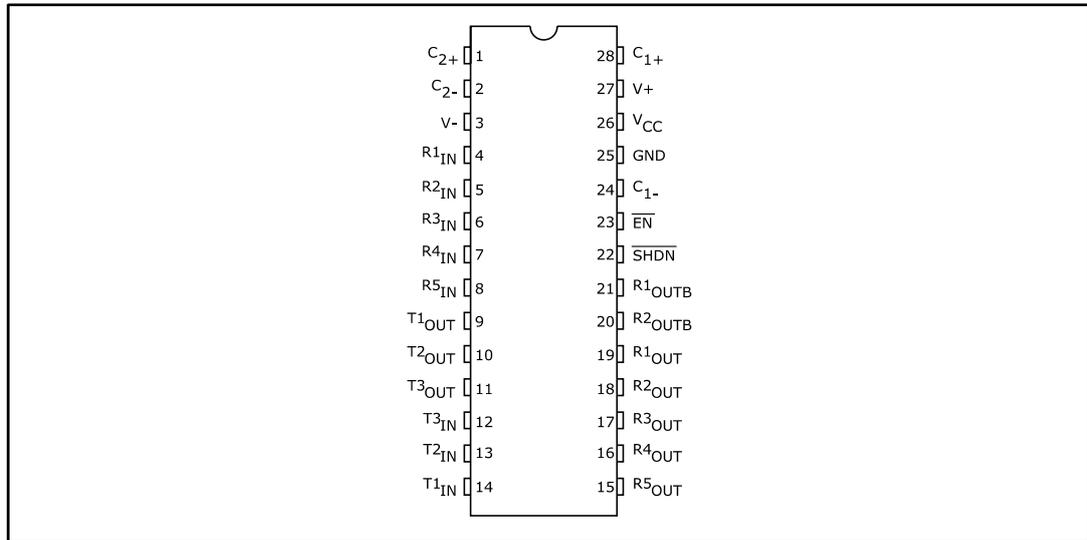


Table 1: Pin description

Pin number	Symbol	Name and function
1	C ₂₊	Positive terminal of inverting charge pump capacitor
2	C ₂₋	Negative terminal of inverting charge pump capacitor
3	V ⁻	-5.5 V generated by the charge pump
4	R _{1IN}	First receiver input voltage
5	R _{2IN}	Second receiver input voltage
6	R _{3IN}	Third receiver input voltage
7	R _{4IN}	Fourth receiver input voltage
8	R _{5IN}	Fifth receiver input voltage
9	T _{1OUT}	First transmitter output voltage
10	T _{2OUT}	Second transmitter output voltage
11	T _{3OUT}	Third transmitter output voltage
12	T _{3IN}	Third transmitter input voltage
13	T _{2IN}	Second transmitter input voltage
14	T _{1IN}	First transmitter input voltage
15	R _{5OUT}	Fifth receiver output voltage
16	R _{4OUT}	Fourth receiver output voltage
17	R _{3OUT}	Third receiver output voltage
18	R _{2OUT}	Second receiver output voltage
19	R _{1OUT}	First receiver output voltage
20	R _{2OUTB}	Non-inverting complementary receiver output, always active for wake-up

Pin number	Symbol	Name and function
21	R1 _{OUTB}	Non-inverting complementary receiver output, always active for wake-up
22	SHDN	Shutdown control, active low
23	EN	Receiver enable, active low
24	C ₁₋	Negative terminal of voltage - charge pump capacitor
25	GND	Ground
26	V _{CC}	Supply voltage
27	V+	5.5 V generated by the charge pump
28	C ₁₊	Positive terminal of voltage - charge pump capacitor

Table 2: Shutdown and enable control truth table

$\overline{\text{SHDN}}$	$\overline{\text{EN}}$	T _{OUT}	R _{OUT}	T _{OUTB}
0	0	High Z	Active	Active
	1		High Z	
1	0	Active	Active	
	1		High Z	

2 Absolute maximum ratings and ESD performance

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

Table 3: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	-0.3 to 6	V
$V+$	Extra positive voltage ⁽¹⁾	$(V_{CC} - 0.3)$ to 7	
$V-$	Extra negative voltage ⁽¹⁾	0.3 to -7	
$V+ + V- $	⁽¹⁾	13	
\overline{SHDN} , \overline{EN} , T_{IN}	Input voltage	-0.3 to 6	
R_{IN}	Receiver input voltage range	± 25	
T_{OUT}	Transmitter output voltage range	± 13.2	
R_{OUT} , R_{OUTB} , $\overline{INVALID}$	Receiver output voltage range	-0.3 to $(V_{CC} + 0.3)$	
t_{SHORT}	Short circuit duration on T_{OUT} (one at a time)	Continuous	
T_{stg}	Storage temperature range	-65 to 150	°C

Notes:

⁽¹⁾ $V+$ and $V-$ can have a maximum magnitude of 7 V, but their absolute addition cannot exceed 13 V

Table 4: ESD performance: transmitter outputs, receiver inputs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	± 15	—	—	kV
		IEC 1000-4-2 (contact discharge)	± 8	—	—	

3 Electrical characteristics

Table 5: Electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified, typical values are referred to T_A = 25 °C

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I _{SUPPLY}	Supply current	No load V _{CC} = 3.3 V or 5 V, T _A = 25 °C	—	0.3	1	mA
I _{SHDN}	Shutdown supply current	$\overline{\text{SHDN}}$ = GND, T _A = 25 °C		1	10	μ A

Table 6: Logic input and receiver output electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{TIL}	Input logic threshold low	T _{IN} , $\overline{\text{EN}}$, $\overline{\text{SHDN}}$			0.8	V
V _{TIH}	Input logic threshold high	V _{CC} = 3.3 V	2			
		V _{CC} = 5 V	2.4			
I _{IL}	Input leakage current	T _{IN} , $\overline{\text{EN}}$, $\overline{\text{SHDN}}$		± 0.01	± 1.0	μ A

Table 7: Receiver output electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
I _{OL}	Output leakage current	R _{OUT} , $\overline{\text{EN}}$, receiver disabled	—	± 0.05	± 10	μ A	
V _{OL}	Output voltage low	I _{OUT} = 1.6 mA				0.4	V
V _{OH}	Output voltage high	I _{OUT} = -1 mA		V _{CC} - 0.6	V _{CC} - 0.1		

Table 8: Transmitter electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{TOUT}	Output voltage swing	All transmitter outputs are loaded with 3 k Ω to GND	± 5	± 5.4		V
R _{OUT}	Output resistance	V _{CC} = V ₊ = V ₋ = 0 V, V _{OUT} = ± 2 V	300	10 M		Ω
I _{SC}	Output short circuit current			± 35	± 60	mA
I _L	Output leakage current	V _{CC} = 0 to 5.5 V, transmitter output = ± 12 V, transmitter disabled			± 25	μ A
V _{TO}	Transmitter output voltage	T _{1IN} = T _{2IN} = GND, T _{3IN} = V _{CC} , T _{3OUT} loaded with 3 k Ω to GND, T _{1OUT} and T _{2OUT} loaded with 2.5 mA each	± 5			V

Table 9: Receiver electrical characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{RIN}	Receiver input voltage operating range		-25		25	V
V _{RIL}	RS-232 Input threshold low	T _A = 25 °C, V _{CC} = 3.3 V	0.6	1.2		
		T _A = 25 °C, V _{CC} = 5.0 V	0.8	1.5		
V _{RIH}	RS-232 Input threshold high	T _A = 25 °C, V _{CC} = 3.3 V		1.5	2.4	
		T _A = 25 °C, V _{CC} = 5.0 V		1.8	2.4	
V _{RIHYS}	Input hysteresis			0.3		
R _{RIN}	Input resistance	T _A = 25 °C	3	5	7	k Ω

Table 10: Timing characteristics, C1 - C4 = 0.1 μ F, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D _R	Maximum data rate	R _L = 3 k Ω , C _L = 1000 pF one transmitter switching	250			kbps
t _{PHL} , t _{PLH}	Receiver propagation delay	R _{IN} to R _{OUT} , C _L = 150 pF		0.15		μ s
t _{T_SKEW}	Transmitter skew			100		ns
t _{R_SKEW}	Receiver skew			300		
S _{RT}	Transition slew rate	T _A = 25 °C, R _L = 3 k to 7 k Ω , V _{CC} = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C _L = 150 pF to 1000 pF	6		30	V/ μ s
		T _A = 25 °C, R _L = 3 k to 7 k Ω , V _{CC} = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C _L = 150 pF to 2500 pF	4		30	

4 Application

Figure 2: Application circuits

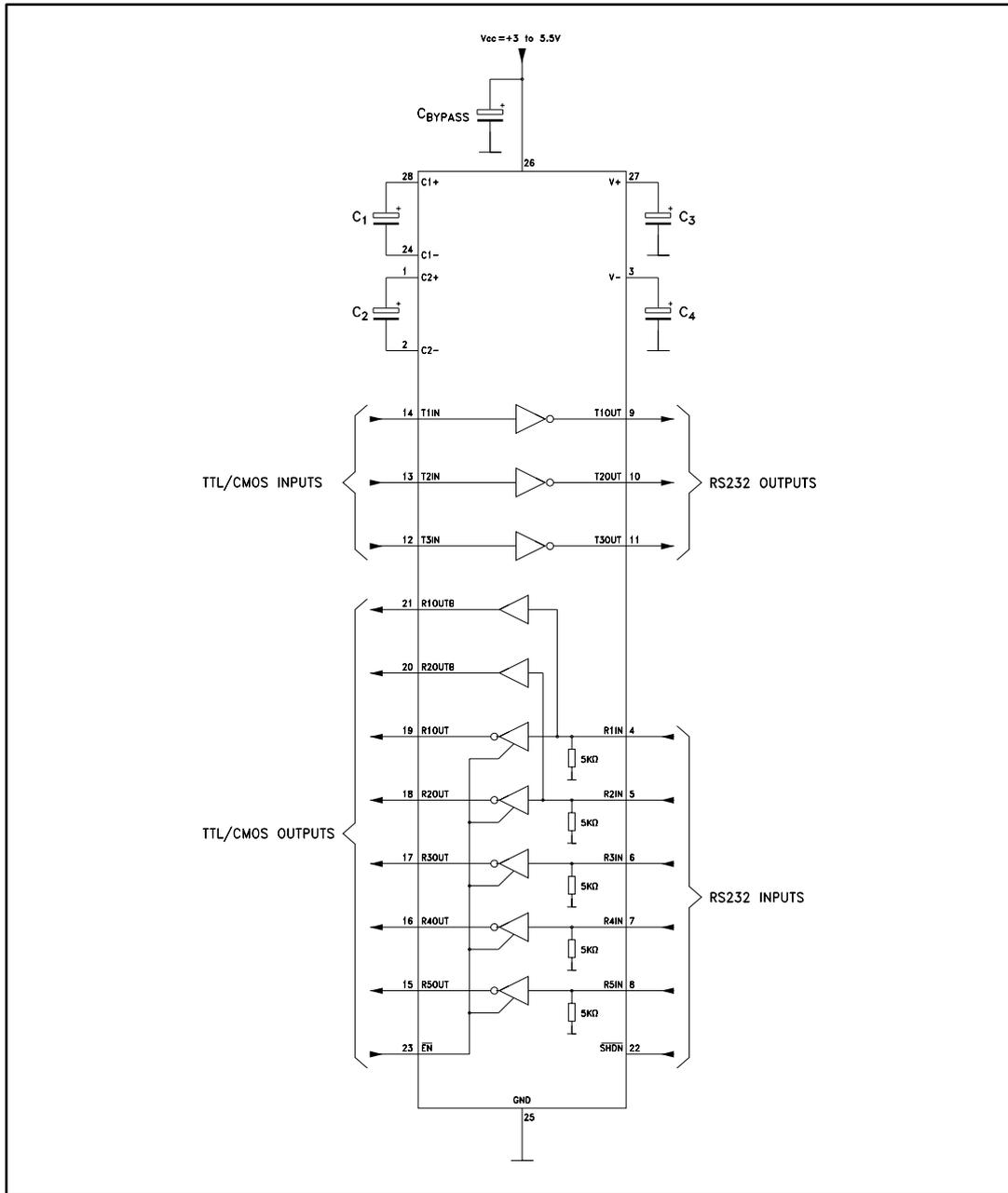


Table 11: Required minimum capacitance value (µF)

V _{cc}	C1	C2	C3	C4	C _{bypass}
3.0 to 3.6	0.1	0.1	0.1	0.1	0.1
4.5 to 5.5	0.047	0.33	0.33	0.33	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

5.1 SSOP 28 package information

Figure 3: SSOP 28 package outline

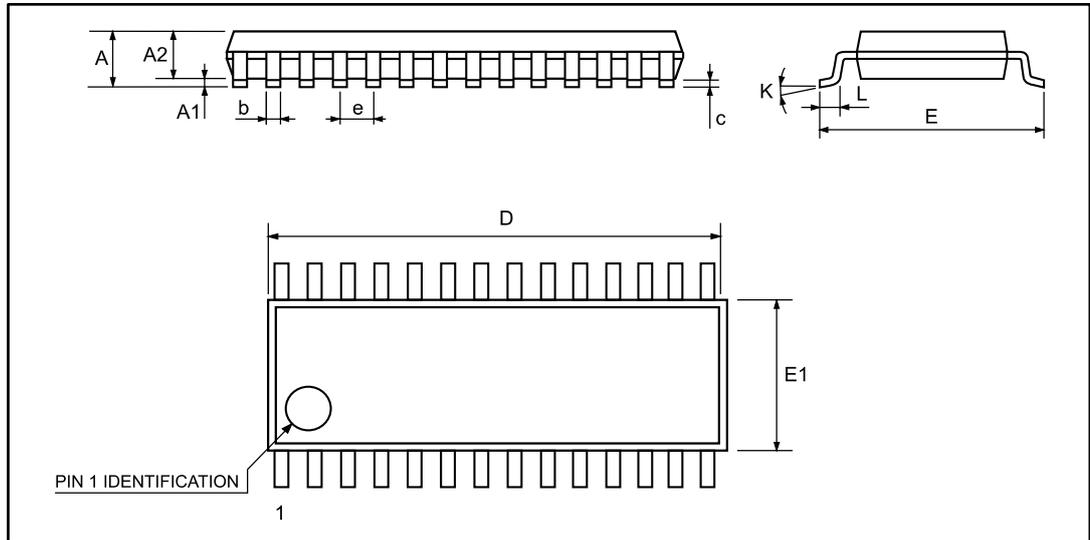
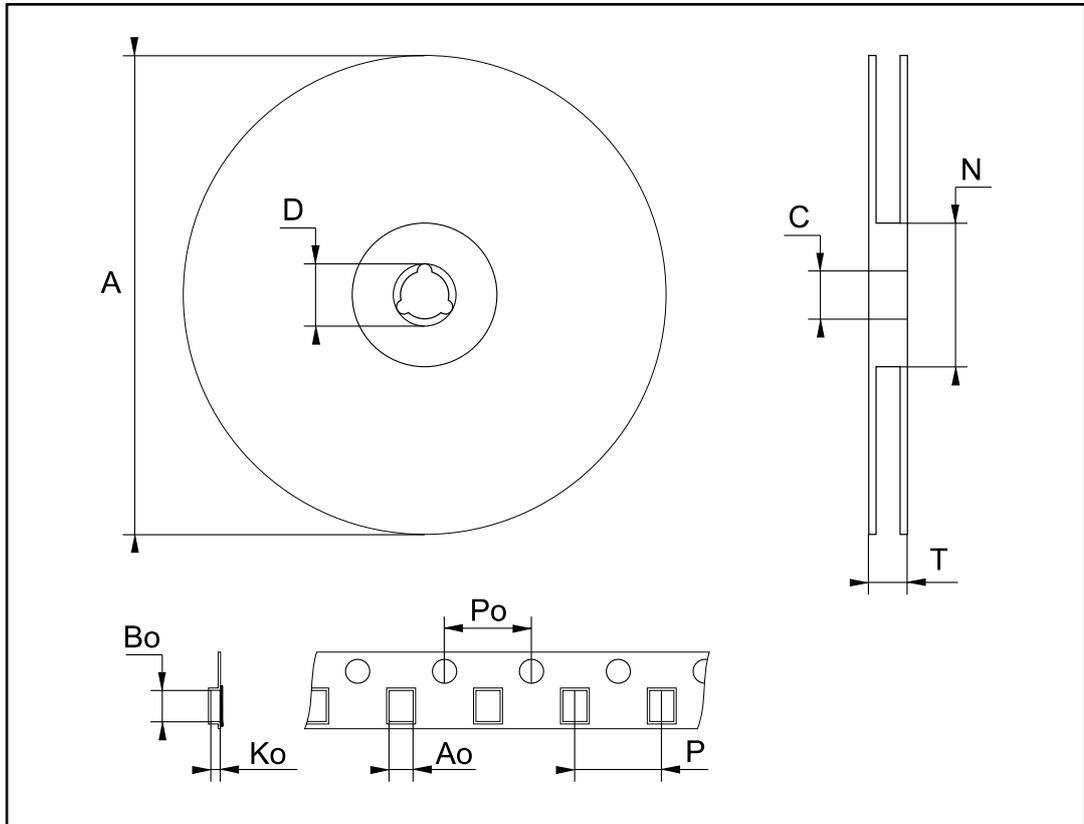


Table 12: SSOP 28 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			2			0.079
A1	0.050			0.002		
A2	1.65	1.75	1.85	0.065	0.069	0.073
b	0.22		0.38	0.009		0.015
c	0.09		0.25	0.004		0.010
D	9.9	10.2	10.5	0.390	0.402	0.413
E	7.4	7.8	8.2	0.291	0.307	0.323
E1	5	5.3	5.6	0.197	0.209	0.220
e		0.65			0.0256	
K	0 °		10 °	0 °		10 °
L	0.55	0.75	0.95	0.022	0.030	0.037

5.2 SSOP 28 tape and reel package information

Figure 4: SSOP 28 tape and reel package outline



1. Drawing is not to scale

Table 13: SSOP 28 tape and reel mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	8.4	—	8.6	0.331	—	0.339
Bo	10.7		10.9	0.421		0.429
Ko	2.9		3.1	0.114		0.122
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476

6 Ordering information

Table 14: Order codes

Order code	Temperature range	Package	Packaging	Marking
ST3241EBPR	-40 to 85 °C	SSOP 28 (tape and reel)	1350 parts per reel	ST3241EB
ST3241ECPR	0 to 70 °C			ST3241EC

7 Revision history

Table 15: Document revision history

Date	Revision	Changes
21-Jun-2004	2	The I _L (Output Leakage Current) mA ==> μA in table 8
03-Apr-2006	3	Order code updated.
13-Nov-2007	4	Added Table 1
28-Sep-2010	5	Removed TSSOP28 package and all references from datasheet; updated ECOPACK® text in Section 5; reformatted document; minor textual updates.
08-Mar-2017	6	<i>Features</i> : updated units of slew rate change (from 6 V/ms to 6 V/μs) Moved "Device summary" table to Section 6: "Ordering information" and added "Marking". <i>Table 12</i> : removed "BSC" from "e" dimension

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